

**IN THE CLAIMS:**

1 Please cancel claims 1 – 9.

1 10. (New) A method of dynamically controlling and managing operating characteris-  
2 tics of a fuel cell system, including the steps of:

3 (A) providing a DC-DC converter circuit having an input connection to re-  
4 ceive the output of a fuel cell, and connected to place a load across the fuel cell, said DC-  
5 DC converter circuit having internal switches that are operated at a duty cycle that is ad-  
6 justable;

7 (B) providing a programmable controller that receives as an input, present and  
8 stored values of one or more operating characteristics, said programmable controller also  
9 being programmed to signal said DC-DC converter switches to adjust its duty cycle;

10 (C) dynamically determining a desired value for one or more operating charac-  
11 teristics of the fuel cell system, depending upon the operating conditions of the fuel cell  
12 system;

13 (D) monitoring one or more operating characteristics of said fuel cell system;

14 (E) calculating a new duty cycle for the associated DC-DC converter within  
15 the fuel cell system required to substantially achieve the desired value for one or more of  
16 said operating characteristics; and

17 (F) signaling said DC-DC converter to adjust its duty cycle to said new duty  
18 cycle.

1 11. (New) The method as defined in claim 10 including the further steps of:

2 (A) identifying a weakest cell in a fuel cell stack;

3 (B) measuring the output voltage of the weakest cell;

4 (C) dynamically determining a desired value for said output voltage;

5 (D) comparing a present value of said weakest cell output voltage with a de-  
6 sired value;

7 (E) calculating a new duty cycle for the associated DC-DC converter within  
8 the fuel cell system required to substantially achieve said desired value for the output  
9 voltage of the weakest cell; and

10 (F) signaling said DC-DC converter to adjust its duty cycle to said new duty  
11 cycle.

1 12. (New) The method as defined in claim 10 including the further step of:

2 (A) monitoring as said operating characteristic, stack output voltage;

3 (B) dynamically determining as said desired value, stack output voltage;

4 (C) comparing a present value of said stack output voltage with a desired  
5 value;

6 (D) calculating a new duty cycle for the associated DC-DC converter within  
7 the fuel cell system required to substantially achieve said desired value for the stack out-  
8 put voltage; and

9 (E) signaling said DC-DC converter to adjust its duty cycle to said new duty  
10 cycle.

1 13. (New) The method as defined in claim 10 including the further steps of:

2 (A) providing at least one battery associated with the output of said DC-DC  
3 converter circuit that is powered by the output voltage of the fuel cell;

4 (B) measuring as said operating characteristics, the voltage of the battery;

5 (C) determining whether said battery should be charged;

6 (D) calculating a new duty cycle for the associated DC-DC converter required  
7 to substantially achieve the desired voltage of said battery; and

8 (E) signaling said DC-DC converter to adjust its duty cycle to said new duty  
9 cycle.

1 14. (New) The method of controlling operating characteristics of a fuel cell as de-  
2 fined in claim 10 including the further steps of:

3 (A) monitoring as said operating characteristics, the output current of a fuel  
4 cell stack;

5 (B) dynamically determining as said desired value, the output current;

6 (C) comparing a present value of said output current with a desired value;

7 (D) calculating a new duty cycle for the associated DC-DC converter with the  
8 fuel cell system required to substantially achieve said desired value for the output current;  
9 and

10 (E) signaling said DC-DC converter to adjust its duty cycle to said new duty  
11 cycle.

1 15. (New) The method of controlling operating characteristics of a fuel cell as de-  
2 fined in claim 10 including the further steps of:

3 (A) monitoring as said operating characteristic, the output power of the fuel  
4 cell stack;

5 (B) dynamically determining as said desired value, the output power of the  
6 fuel cell stack;

7 (C) comparing a present value of said output power with a desired value;

8 (D) calculating a new duty cycle for the associated DC-DC converter within  
9 the fuel cell system required to substantially achieve said desired value for the output  
10 power; and

11 (E) signaling the DC-DC converter to adjust its duty cycle to said new duty  
12 cycle.

1 16. (New) A method of controlling a fuel cell system, including the steps of:

2 (A) dynamically determining desired values for a plurality of operating char-  
3 acteristics being monitored in a current mode of operation of a fuel cell system;

4 (B) measuring each of said selected operating characteristics;

- 5 (C) determining a duty cycle required to substantially achieve each individual
- 6 desired value and storing each duty cycle;
- 7 (D) comparing stored values and selecting the minimum duty cycle; and
- 8 (E) using this duty cycle as the new duty cycle of the DC-DC converter circuit
- 9 switches within said fuel cell system;

1 17. (New) The method as defined in claim 16 including the further step of:  
2 periodically repeating determining the desired values and the measurements and  
3 updating the duty cycle.

- 1 18. (New) A method of measuring fuel cell concentration in a fuel cell system:
- 2 (A) identifying the weakest fuel cell in a fuel cell stack;
  - 3 (B) increasing the overall stack output current until the voltage of the weakest
  - 4 fuel cell approaches zero;
  - 5 (C) measuring the stack output current as a limiting current;
  - 6 (D) determining whether concentration is too high or too low, based on the
  - 7 measured current value; and
  - 8 (E) dosing additional fuel or water should a desired value not be met.

- 1 19. (New) A method of dynamically controlling and managing temperature in a fuel
- 2 cell system, including the steps of:
- 3 (A) measuring the stack output voltage of the fuel cell system;
  - 4 (B) determining whether the stack output voltage is at a desired value depend-
  - 5 ing upon the present desired temperature range of the fuel cell system, for the present op-
  - 6 erating conditions, and
  - 7 (C) adjusting the duty cycle of an associated DC-DC converter to change the
  - 8 output stack voltage to substantially the desired value.

- 1 20. (New) A method of dynamically controlling the output power of a fuel cell sys-
- 2 tem including the steps of:

- 3           (A)     dynamically determining a desired value for the output power of the fuel
- 4 cell system, depending upon the present operating conditions of the fuel cell system;
- 5           (B)     measuring the output power of the fuel cell system;
- 6           (C)     if the desired value is not substantially met, measuring fuel cell concentra-
- 7 tion;
- 8           (D)     adjusting fuel cell concentration to substantially achieve the desired value
- 9 of the output power of the fuel cell system; and
- 10          (E)     adjusting the overall stack voltage to substantially achieve the maximum
- 11 output power of the fuel cell system.